

which is sufficiently constant, our most successful results having been obtained with a six-horse power Córliiss engine, with a heavy fly-wheel, in the workshop of the College.

Some experiments which promise well have been made with rotating disks on the principle of the thaumatrope. By using a rotating disk with slits, and viewing through them another disk on which appropriate figures or symbols are marked, the velocity of one can be determined if that of the other is known. This principle may possibly be applied with advantage to determine the relative velocity of two machines, such as the twin screws of ships.

Without pretending that the method described in this paper for determining the velocity of rotation will be useful on an extensive scale, we hope that it may be applicable in some cases of investigation where accurate observations can be rapidly made without any complex apparatus or difficult manipulation. It has the advantage that it can be applied directly to a machine without the intervention of any gearing, the mere attaching of a piece of paper to a shaft being all that is necessary. It cannot, by giving the machine more work to do, produce any effect on its rate; and by the impossibility of slip, it must give accurate results if the paper is properly mounted in the first instance and the observations are properly made.

Being an optical method for investigating rotation, we suggest cyclo-scope as a name for the instrument.

*April 26, 1877.*

Dr. J. DALTON HOOKER, C.B., President, in the Chair.

The Presents received were laid on the table, and thanks ordered for them.

The following Papers were read :—

1. "On the Nature and Origin of the Beds of Chert in the Upper Carboniferous Limestones of Ireland." By Prof. EDWARD HULL, M.A., F.R.S., Director of the Geological Survey of Ireland. With "Chemical Notes," by E. T. HARDMAN, F.C.S., of the Geological Survey of Ireland. Received March 16, 1877.

(Abstract.)

After reviewing what had been published by previous authors on the origin of chert-beds, and showing that much remained to be done in this department of petrology, the author proceeded to describe the geological

position of the principal cherty zone of the Carboniferous Limestone of Ireland, showing that, while bands of chert occur at intervals throughout this formation, the highest beds immediately under "The Yoredale Shales" are especially rich in chert, and are frequently entirely replaced by this mineral. In these beds coralline, crinoidal, and other marine forms were frequently to be recognized by the naked eye. Thin slices for microscopic examination, taken from various localities, extending from Sligo to Carlow, also showed that even the most dense and compact masses of chert exhibit, under favourable circumstances, forms belonging to those marine animals (such as corals, crinoids, foraminifera, and occasionally mollusks) which build their shells or skeletons of carbonate of lime rather than of silica. The siliceous paste in which these forms are enclosed was found to be in a gelatinous state; and the forms were only to be distinguished by difference in depth of shade from the paste, the shells or skeletons having disappeared. The chemical analyses of these specimens by Mr. E. T. Hardman, F.C.S., tended to show that the chert-beds contain various proportions of carbonate of lime as well as other minerals, so that a gradation from siliceous limestone into pure chert might be traced.

From a review of the whole circumstances, it appeared that the origin of the chert-beds was to be attributed to the replacement of the original limestone or calcareous "ooze," due to organic agency, by silica, and that the rock is truly a pseudomorph, a view held by several observers.

The manner in which this replacement had been brought about was then touched upon. It was shown that there was reason for believing that at the close of the period during which the Carboniferous Limestone was formed over the area of Central Ireland, the sea-bed was elevated, so as to be covered by the waters of a shallow sea, exposed to the sun's rays, and of a warmer temperature than when at a greater depth. The waters appear to have been charged with a more than usual supply of silica in solution, derived (as Mr. Hardman suggests) from the surrounding lands, formed, for the most part, of highly siliceous materials. As silica is less soluble than carbonate of lime, chemical replacement would naturally take place, the carbonate of lime being dissolved out and its place taken by the silica. The warm condition of the sea-water, its exposure to sunlight, the porous character of the coralline, crinoidal, and other forms, and the soft and "oozy" condition of the foraminiferal mud would give easy access to the sea-waters, and a process of silicification would take place analogous to that described by Dr. Martin Duncan, F.R.S., as having occurred in the West Indies.

The paper was accompanied by chemical analyses and photographic figures of some of the thin slices, slightly magnified.